

Media Optimization Algorithm

Next Generation Big Data Powered Media Planning & Buying System. A Whitepaper By Marketing Evolution

Abstract

Agencies, marketers, media owners, and other interested parties want to be able to easily use software to develop media budgets and execute media plans based on Big Data and facts about return on investment (ROI). Marketing Evolution identified six elements of an ideal solution. This paper reviews the needs and explains Marketing Evolution's ROI Brain™ software. The paper takes a close look at the algorithm that powers the ROI Brain™'s media mix recommendations. The paper includes a brief description of other elements of the ROI Brain™ to provide a comprehensive view of the overall system.

The Needs

1. Big Data

An agency, marketer or media owner wants to use a variety of data to orient the selection of paid and owned media. The two most important big data types relate to impact and audience. Impact data can cover a range of key performance indicators, including sales, brand awareness, App downloads, foot traffic, etc.). Audience data can include basic demographics, consumer intent data culled for digital behaviors, location data (such as store latitude and longitude and the ability to deliver advertising within a defined proximity to the store), weather triggers, social media triggers, and more.

2. Planning

Agencies and marketers have a wide range of possible media they can use. They want to *plan* how much to spend on different tactics based on their specific business objectives and target audience. In some cases, the marketer or agency may not have ROI benchmarks for every media. In such cases, agencies and marketers want to compare the plans generated on based on their historical data with plans generated based on a wider set of ROI benchmarks.

Media owners often have a portfolio of media they can sell. They want to bring a plan to agencies and marketers that provides the best value to both marketer and media owner based on the marketer's target audience and business objectives. Media owners would like to compare a plan that includes their media versus plans that do not so they can demonstrate the value the media owner adds to the marketer.

3. Buying

As a media plan takes shape, an agency, marketer and media owner wants the transition from planning to buying to be an easy task. This means the data from the media plan carries over into buying systems as it simultaneously populates a marketing calendar and flowchart.

4. Best Practices

Once a media budget is finalized, an agency, marketer and media owner wants Best Practices specific to their media used in the plan to help achieve the best results possible. This increases the effectiveness of advertising, which is good for marketer, agency and media owner alike.

5. In-Flight Reporting & Optimization

Agencies, marketers and media owners want to know the delivery of a media buy. They want "as ran" reports. Agency, marketer or media owners wants to know the ROI performance of a campaign, down to the individual message level as the campaign runs so that in-flight optimization can be executed to increase performance. The data should show if some people are more influenced by certain messages and media combinations than others. This data is used for message rotation by audience. It can also be used to purchase incremental media placements targeted to the people most responsive to any given messages, or to swap

media placements to increase ROI.

6. Post Campaign ROI Learning & Database

After a campaign is over, agencies, marketers and media owners want post-campaign analytics to match what was guaranteed to what was delivered, evaluate ROI, and feed into their own brand specific ROI benchmarks to aid in future planning.

Separate Components

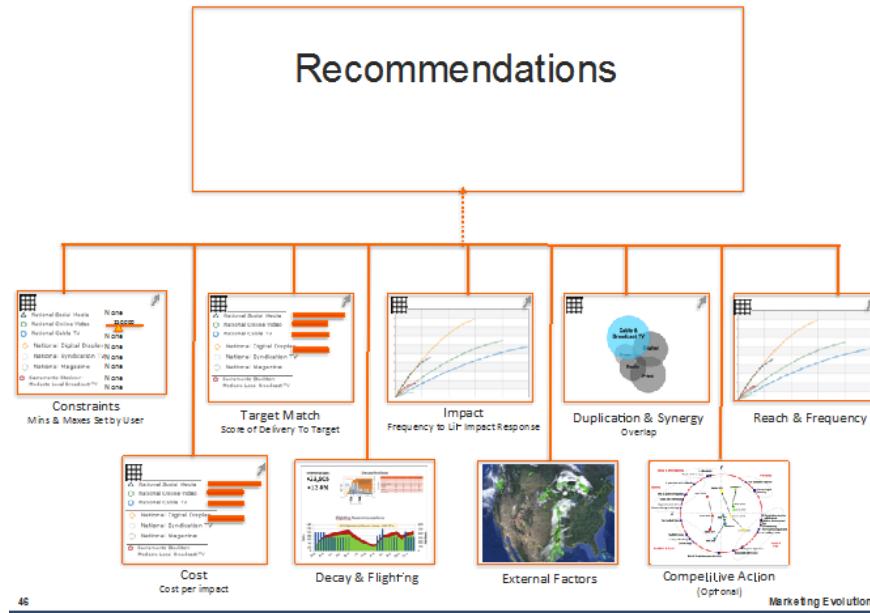
Agencies, marketers, and media owners want to be able to pick and choose components of the software they adopt. For example, one might adopt the Plan, Buy and Best Practice components, but choose to skip *In-Flight Optimization*, and use their own Post Campaign ROI measurement.

Solution: The ROI Brain™ Optimization

Based on the six needs identified, Marketing Evolution developed the ROI Brain™. A key component of the ROI Brain™ is the optimization algorithm, which combines big data, and media planning. It is used during In-Flight Optimization to adjust the media mix, and for Post-Campaign ROI Reporting. A six minute video summarizes the main components of the algorithm: www.marketingevolution.com/monica_algorithm/ and this document addresses each element of the algorithm.

The ROI Brain™ Optimization Algorithm is composed of the following elements:

1. Impact
2. Cost
3. Reach & Frequency
4. Duplication & Synergy
5. Decay/Carryover Effects & Recency
6. Audience Selection
7. Message Response By Audience
8. Fully Addressable Media
9. Constraints
10. External Factors/Competitive Factors
11. Over-rides



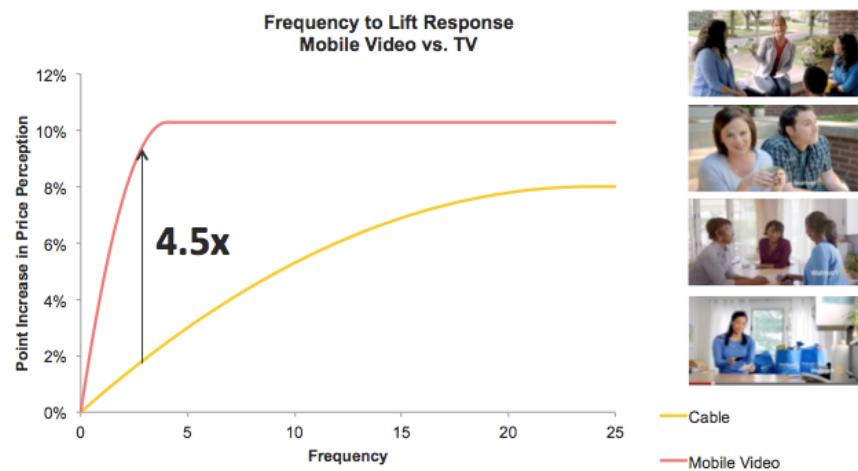
#1 Impact

Impact by frequency is a valuable way of reporting the effectiveness of a different media channels.

In the SMoX study, Marketing Evolution found that the same video advertisement worked differently in cable TV than it did on a mobile device.

Studying the Impact by frequency shows that the advertisement is more effective when viewed on a mobile device, but it also hits diminishing returns and stops producing incremental value at a much lower frequency.

Although mobile is more effective in this case, it does not mean it should get a larger share of the budget. The relative costs of the two media channels is factored into the Spend to Impact Response Function (SIRF), as well as Reach & Frequency, Duplication & Synergy and Decay/Carryover Effects.



#2 Cost

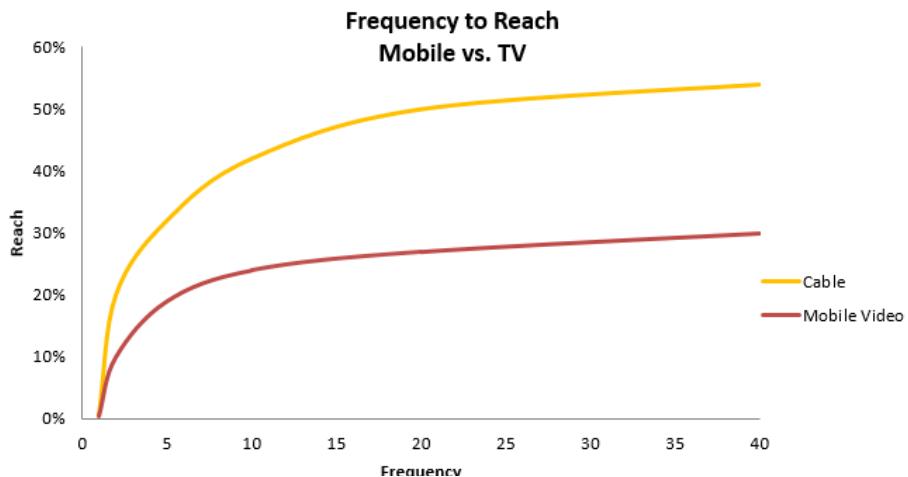
Impact by frequency and the Cost per impression are combined into a Spend To Impact Response Function (SIRF). Most media is sold on an impression basis, making the relationship of cost to impression delivery simple. Some media is purchased on cost per activity basis (such as clicks, downloads, etc.). This can also be translated into a SIRF. In the SMoX study we mentioned above, mobile costs 40 percent less than cable TV, meaning the ROI Brain™ will allocate spending toward mobile until the point where diminishing returns makes it less valuable than cable TV.

In auction-based media buying, where cost can vary, the ROI Brain™ can run multiple scenarios and recommend tiers of spending based on cost. Deal/No Deal output can also be generated to determine when to take a price offer for inventory and when to spend the budget elsewhere. Media owners can use the software to evaluate if their pricing is in line with value creation and to see if the win-win of increasing impact, which helps the marketer get a higher ROI, justifies higher rates for the media owner.

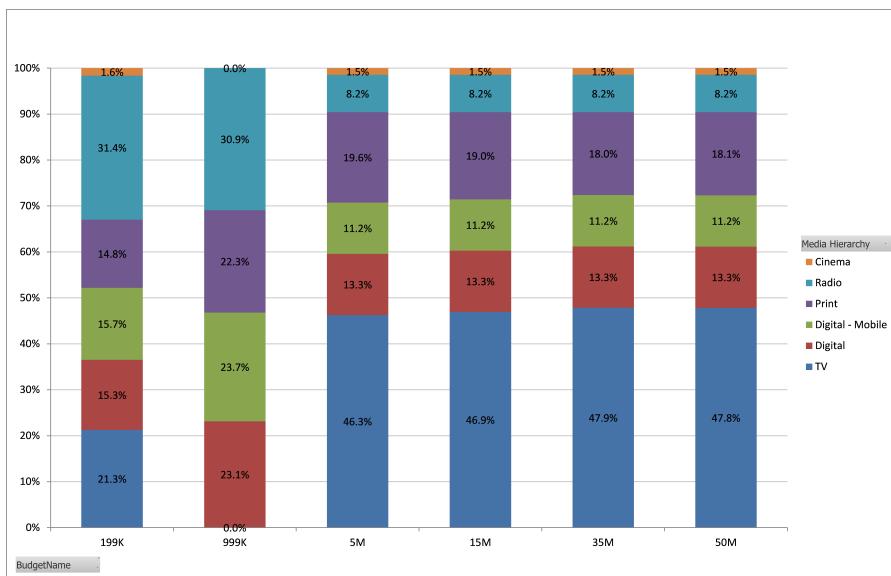
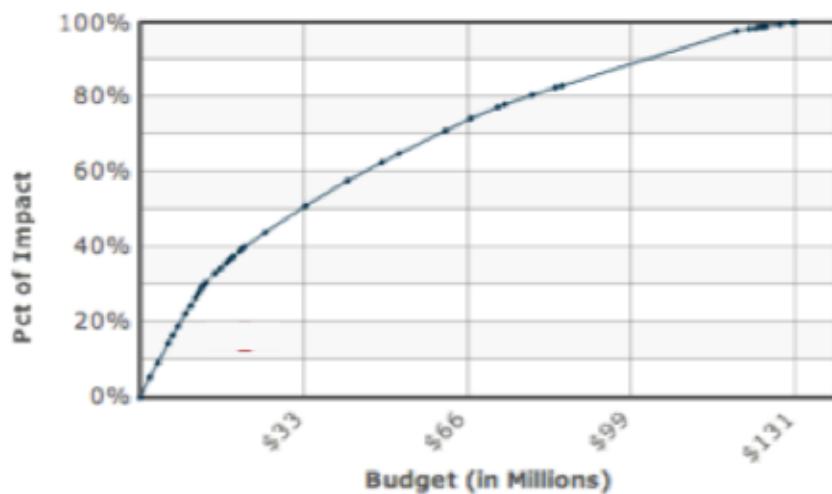
#3 Reach & Frequency

Reach & Frequency of a media are an important aspect to any media plan. Incremental Reach means another person will see the advertisement for the first time (frequency = 1). Incremental Frequency means the same person will see an additional exposure to the advertisement – which is at a diminished return, as noted in the impact curve above. When spending more on a media touchpoint that is not addressable, there is generally a combination of some people that are reached for the first time (Incremental Reach) and some people that are receiving additional frequency. The data in the ROI Brain™ incorporates Reach & Frequency curves and is updated as the data becomes available.

The SMoX mobile video and cable TV example illustrates that mobile has less reach and scale than cable TV. For a small budget, mobile gets a larger share of the marketing spend, but as budget increases, cable TV gets more and more of the media mix because it has more overall reach and scale.



Looking at the SIRF chart below, we can see how the media mix changes as budget increases.



#4 Duplication & Synergy

Duplication & Synergy play a large role in the allocation of media. Duplication means reaching the same person in a different media channel. This is similar to frequency, except sometimes there is a synergistic impact that adds value. Other times, duplication is the same as additional frequency, and delivers diminished return similar to adding frequency in the same media.

Another type of synergy is a complementary effect (or as some call it, “Indirect effects”). An example of a complementary effect is seeing an advertisement on TV, or out of home, in a magazine or on the radio, etc. and then being more likely to click on an advertisement that leads to a purchase. Rather than the last click getting all the credit, we measure the synergist combination of media contributing to the sale. This phenomenon has been well documented by Marketing Evolution for more than a decade, and we group complementary effects into the synergy term.

To the extent we observe synergy levels to counteract the diminishing returns between media channels, the ROI Brain™ will seek to select media placements that increase duplication.

Generally, incremental reach is more valuable than duplication for objectives such as awareness, and brand perception; whereas synergistic complementary effects are more valuable when trying to influence behaviors, such as foot traffic and sales.

#5 Decay/Carryover Effects & Recency

Decay/Carryover Effects & Recency factor into the equation as we look at optimal spending over a period of time. Keeping a brand salient such that the person is more likely to select the brand over a competitor requires periodic connections with the consumer. Without additional message exposures, the impact will decay over time. The other way of looking at this is to say that a message impact carries over for some period of time. By measuring the impact of the message exposure at different points in time, we can chart the decay/carry-over effect.

The ROI Brain™ supports optimizing flighting based on different dynamics, such as a product launch on a specific date (e.g. a movie release) or a perishable product (offer expires/sales event ends) by using the recency and decay terms.

#6 Audience Selection

For years, audience selection was about picking a demographic such as an age and sex combination. Big Data has changed this to selecting customers, or building look alike models to predict who will be the next customers. Audience Selection, of course, changes the optimization recommendation. For example, the share of mix devoted to mobile is higher for a younger audience than an older audience. This is mostly due to different penetration levels of smart phones (factored into the reach and frequency equation) rather than a difference in impact, or decay rates, per se. When selecting a Big Data culled variable, such as eXelate’s segment of “High-end Home Owners” the ROI Brain™ integrates all the media usage for this population of people – and this adjusts the media mix accordingly.

Audience Selection plays a much more significant role when looking at specific media properties optimized through the ROI Brain™. While the television budget may be similar when selecting two different audiences, the individual networks, dayparts and programs included in the optimization will differ accordingly.

Audience Selection effects in the ROI Brain™ are clear when looking at local media optimizations. In addition to selecting an audience, the ROI Brain™ uses store locations. For example, for a regional restaurant chain, the optimization will recommend more spending in media channels that can match the geographical footprint. National optimization will still be included to the extent that the waste in delivering to areas with few customers, or little to no stores can be offset by lower media costs or greater impact.

One can expect more local media recommendations when selecting an audience that has geographical skews. To continue with the TV example, this may include more local TV buys, zoned cable, and addressable TV, as well as national shows that have viewership that match the local skew, such as sporting events among teams from the relevant region, or out of home (which is

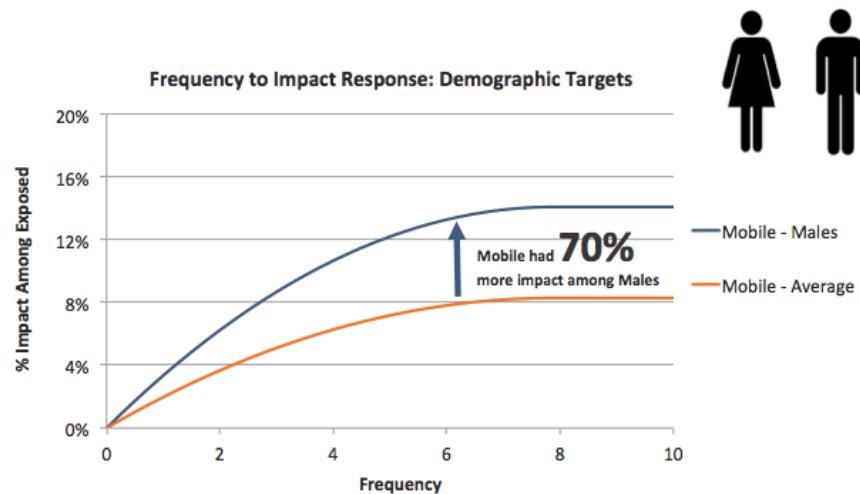
local by nature), or geo-fenced mobile, local radio, or other geographically targetable media may also vie for the regional marketer's budget.

In our experience, audience selection is a strategically essential element of planning in this new world of highly targetable audiences. Marketing Evolution's ROI Brain™ includes a wide range of audiences to choose from. However, if an agency or marketer has a proprietary segmentation of customer files, this can be uploaded and used within the software. The ROI Brain™ also makes it easy to upload custom audience segments using MRI, Scarborough, eXelate, or proprietary customer address files. All address data is kept in a separate password protected data locker.

#7 Message Response By Audience

Creative Response by Audience always plays a significant role in the ultimate ROI a marketer achieves. However, when building an optimization plan months in advance, optimization may assume "average creative impact" from historical benchmarks of ROI performance. Consequently, if one campaign works great among women, and another great with men, the average may be the same, but the optimal media mixes would be very different.

To illustrate this point, in SMoX, Marketing Evolution found a 70 percent difference between men and women for a mobile advertisement.¹



In practice, this marketer built their media plan on a broad 18-49 demographic. The moment they saw that the message would perform better among men, they should re-run the optimization, feeding in the creative impact by audience profile weights. These weights will adjust the media mix accordingly. In this case, the upside was over 40 percent in terms of better sales performance from the exact same budget by re-running the optimization for the creative message's audience impact.

More common a heat map (shown on next page) displays where the message impact is most pronounced among a specific segment of the population defined by multiple profile dimensions.

¹ The impact is charted by frequency. Applying the cost to reach men versus women converts this impact curve into a SIRF, which can then be optimized.

Targeting Response	TV		Magazine		Digital	
	Ad 1	Ad 2	Ad 1	Ad 2	Ad 1	Ad 2
Gender: Male	Red	Green				Red
Gender: Female	Green					Green
Age: P45+			Red	Green	Red	
Marital Status: Now married	Green	Red		Green		Green
Children under 18	Green			Green		Green
HH Income: Over \$150K	Green		Red	Green	Red	Green
eXelate - MutualFunds Investor		Green				
eXelate - Reliable CC Payers		Green				
Exelate - Female Purchase Decision Makers (HOH)	Green					
Exelate - High End HomeOwner		Green				
category.Family	Green			Green		Green
category.organic food interest		Green		White		
category.wine interest	Green		White	Green	White	Green
category.local.business	Green		White	Green	White	Green
Emerging Affluent	Green	Red				Red
Global Citizen		Green	White	Red	Green	Red
Progress Makers	Green		White	Red	Green	Red
Loyalists		Green	White	Green	White	Green
23 Trendsetters	Red	Green	Green		Green	
44 Urban Melting Pot	Red	Green	Green		Green	
31 Rural Resort Dwellers	Green					
33 Midlife Junction	Green					
24 Main Street, USA						Green
51 Metro City Edge	Green					
46 Rooted Rural	Red	Red				
27 Metro Renters		Green	Green		Green	

The ROI Brain™ is designed to take these weighted factors displayed in the heat map into consideration when optimizing message rotation and media mix.

Given the importance of creative, and the ever-expanding ability to target messages within media, the user can upload creative pre-testing results² and ROI Brain™ will optimize accordingly. For those using Marketing Evolution's in-campaign ROI measurement, the software will adjust the creative mix and media optimization based on which messages are most influential among consumers on the marketer's KPIs.

#8 Fully Addressable Media

Marketers have made use of fully addressable media for years, starting with direct mail. Increasingly, marketers can tap into addressable TV, selective binding in magazines, re-targeted digital, mobile and more. At present, some addressable media can select a specific message for the individual that is dynamically assembled. Since we have found that personalized messaging performs better than mass messaging, the impact curve is indexed higher than the overall media. At the same time, the waste is reduced, thanks to the targeting. Typically, addressable media comes with a higher price tag which is why ROI Brain™ also evaluates if the additional cost is worth the better targeting and higher impact.

#9 Constraints

When a marketer has made up-front commitments, or multi-year commitments, the ROI Brain™ takes this information as the starting point from which to layer on additional media. Rather than a zero based media plan, the preexisting pattern of exposure is used to calculate the incremental reach and synergy dynamics when adding additional media. The ROI Brain™ has several options for setting constraints. First, it can be set to spend **exactly** the amount committed to. Second, it can be set to spend a **minimum** of what is committed to, and the ROI Brain™ is free to spend more if it is warranted, based on the optimization

² Marketing Evolution provides a format to map 3rd party pre-testing to the software's media optimization.

recommendations. Third, the ROI Brain™ can be set to spend a maximum amount, but is free to spend less. Finally, ROI Brain™ can be set for a **cost of entry** level, meaning that ROI Brain™ has to be able to get over the cost of entry minimum hurdle, or it will not recommend spending on the lever. This last option is useful when dealing with a minimum order size, or minimum spend to justify message development.

Bundling rules can be included in the constraints with configuration, and is included in the *expert* version of the ROI Brain™ software.

#10 External Factors/Competitive Factors

Some categories are significantly influenced by External Factors, such as seasonality, weather patterns, competitive pricing, competitive advertising, etc. The ROI Brain™ factors this in by indexing the impact curves accordingly. For example, if sales drop 10% when it rains, then the software can account for the predicted rainfall by DMA, by week. It can do this by using the historical average, or can do this by using Marketing Evolution's 10 Day Weather Forecast sourced from the National Oceanic and Atmospheric Administration (NOAA). NOAA data is also available in Marketing Evolution's software in real-time.

Weather, as well as an assortment of other common External Factors, are included in the expert version of the ROI Brain™. A user can create their own seasonality patterns, and integrate the elasticity curves within the ROI BrainTM as part of the BYOD – Bring Your Own Data option.

#11 Over-rides

Human judgment can be entered into the ROI Brain™ by an agency or marketer by indexing the impact slider. The software records and notes the human judgment Over-rides in the output. Some use this human judgment feature to run what-if scenarios. For example, "what-if this media item was 30 percent more impactful? Would we include it in the plan?"

Another way that human judgment can be included in the software is to create media characteristics. For example, one media company used social media buzz to classify TV shows as water cooler discussion drivers. They believed this would correlate with the impact they would likely see for their campaign, whose KPI was to be part of pop-culture in a way that the underlying historical ROI impact data might miss.

An agency believes the self-stated consumer surveys on which media they turned to for news, or entertainment was useful in media selection. They used the software as a way to apply their own view of impact, while still benefiting from all the other features of the software.

Agencies, marketers, and media owners can use the ability to index the impact curves based on human judgment. While Marketing Evolution believes the superior approach is to use in-market observational research on ROI to form impact curves, we recognize the value of being open-minded and empowering agencies, media owners and marketers to be innovation. We hope that those applying human judgment to the impact curves will close the loop with ROI measurement to validate or invalidate the human judgment.

Calculating the Optimal Mix

Calculus is applied to generate the optimal combination of media that generates the greatest overall impact. Those familiar with calculus will recognize that optimal mix can be solved with each element of the media mix presented as a quadratic equation that describes the shape of the curve. Those a little rusty on calculus can think of it this way:

You can visually find the best ROI by moving from the left side of the chart to the right side. Whichever line you hit first, the line with the steepest slope, has the highest ROI.

The ROI Brain™ goes through each dollar to be spent, one at a time, starting with zero. The ROI Brain™ then places the dollar wherever the slope is steepest. Since there are diminishing returns, the next dollar spent will have a slightly lower ROI (a slope that is less steep) in the same media. The ROI Brain™ looks to see if there are any places with a steeper slope in which to place the next dollar.³

There are currently over one million individual line items of media planning detail in the software. The media levers are grouped into major categories (ie. TV stations, radio stations, etc.). We use the term levers because each media lever produces lift in the marketer's key performance indicators. New levers are added as new data becomes available or as they are requested by users. In practice, this marketer built their media plan on a broad 18-49 demographic. The moment they saw that the message would perform better among men, they should re-run the optimization, feeding in the creative impact by audience profile weights. These weights will adjust the media mix accordingly. In this case, the upside was over 40 percent in terms of better sales performance from the exact same budget by re-running the optimization for the creative message's audience impact.

Marketing Evolution's approach to generating SIRFs is known as "customer-centric" or bottom-up. In other words, it starts with individual consumers and their exposure to individual messages in each media. The analysis includes both a census level view of all exposures and all sales, and a sample of individual consumer response for metrics not available at a census level, such as awareness and brand perceptions. This approach allows a marketer to adjust factors and to see the influence on the optimized plan. For example, what if we want to adjust the audience the messages are being delivered to? What if smartphone penetration changes, and the reach of mobile video increases significantly? What if the price of media changes? The bottom-up solution is designed to be flexible enough to incorporate these changing factors in the optimization automatically. The individual touch-points build up from the most granular level of detail into overall budget recommendations for the media channels.

Integrating Existing Mix Models Into The ROI Brain™

The ROI Brain™ software is designed to integrate third party ROI data when desired by the marketer, advertising agency or media owner. This is useful for marketers that have an accepted high level mix model that is missing media such as mobile. Marketers, agencies or media owners that want to see where mobile (or other media) fits in to their mix can use the ROI Brain™ for an immediate answer. Agencies, marketers or media owners can use their own econometric marketing mix model, attribution model, or design of experiments, and the ROI Brain™ software will calibrate accordingly. Typically, marketing mix modeling, is at a much less granular level of reporting, making it less useful for detailed media planning and buying. Marketing Evolution's ROI Brain™ takes the more granular individual media SIRFs from Marketing Evolution databases and adjusts them to match the less-granular level SIRFs provided from the mix model. This ensures the marketer can get the same high-level answer for the media in their mix model from the ROI Brain™, while filling in details missing from their mix model.

Another reason marketers, agencies and media owners use the ROI Brain™ software with their existing mix model is because it is improves buying media. The software connects with Marketing Calendars, Best Practices, and Programmatic Buying Platforms. Measuring ROI, both in-flight and post campaign is easier too, because the software is designed to directly feed ROI measurement systems.

³ If you are interested in learning more about SIRFs, the book SIRFs-Up: The Story of How Spend To Impact Response Functions (SIRFs), Software & Algorithms Are Changing Marketing is available for free as an App on the iPad, or for purchase at Amazon.

The software functionality includes:

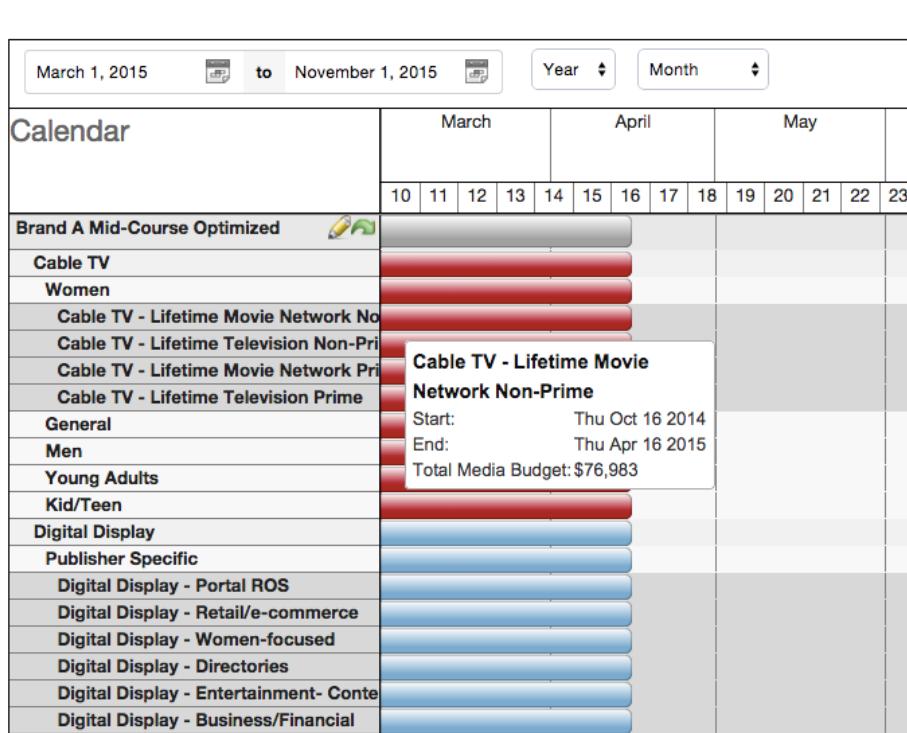
1. Create benchmark media plan in under 2 minutes
2. Compare a plan to industry benchmarks
3. Use your own audience, ratecard and impact adjustments
4. Refine your media plan based on creative pre-testing
5. Adjust targeting and local/national buying with customized Brand Development Indexes (BDI) and other local indexes (e.g. real-time weather)
6. Close the loop and measure ROI in real-time, for message and media optimization

Planning, Buying, Calendar & Tracking, Best Practices & ROI

The ROI Brain™ makes the process of media planning faster, and more data driven. The software is designed to hand off plans to buyers in the same system, which significantly reduces labor intensity and potential errors in moving from planning to buying. This is particularly helpful for media such as out-of-home, local radio and local TV, which developed a reputation for being hard to plan, buy and measure. The ROI Brain™ makes it easier.

The ROI Brain™ connects with popular media owners and buying platforms, and automates inventory requests for those not yet directly connected to the software.

The ROI Brain™ generates a web based Marketing Calendar and Flowcharts, which eliminates the headaches of multiple excel versions and the data re-entry labor.



⁴ <http://www.marketingevolution.com/tedtalks>

⁵ <http://www.marketingevolution.com/videos/bpe>

The ROI Brain™ integrates with TV watermark / ADID as well as digital tagging, and LiveRamp. This speeds up the process of matching the plan with the buy, with delivery. At any given point in time, an agency or marketer can see the state of their media plan and delivery.

Another industry leading feature is the Best Practice Engine. The ROI Brain™ is sophisticated enough to see which media channels are included in the plan, and to proactively deliver relevant Best Practices to the members of the team based on their role. (Please see TED Talk⁴ for the purpose of best practices or the 3min demonstration video of Best Practices⁵). Proactively delivering best practices has been proven to increase a marketer's ROI.

There are over 300 best practices programmed in the software. These best practices are curated by Marketing Evolution and contributed by leading trade associations. The best practices are based on Marketing Evolution's ROI research as well as third party research published in respected sources. Media owners, agencies or marketers can also author their own best practices. A media owner may wish to make their best practices "public" so that all agencies and marketers can benefit from the data driven wisdom. Agencies and marketer's can choose to make their best practices "private" which means only their team will receive their best practices.

ROI Measurement

We highly encourage those using the ROI Brain™ software to close the loop with ROI Measurement. ROI Measurement can be provisioned from Marketing Evolution, or can be sourced from any provider that formats their output using the ROI Brain™ template. By feeding ROI data back into the ROI Brain™, agencies and marketers can shift from using industry benchmarks to using their own brand specific ROI data in the ROI Brain™ planning module.

For More Information

For a live demonstration, methodology deep dive, or other information, contact: info@marketingevolution.com.